Theories and Models of Language Change
Session 4: Evolutionary Approaches - Replication

Roland Mühlenbernd

May 12, 2015
Motivation: Universal Darwinism

Mechanisms of universal evolution:

1. *variation*: continuing abundance of different elements

2. *selection*: number/probability of copies of elements - depending on interaction between element features and environmental features

3. *replication*: reproduction/copying of elements
Linguistic Selection: Choose a Variant

d\left( ^{\text{æ}}_{\text{x}} \right) \text{ns}  

you can’t tip \left( ^{\text{a}}_{\text{no}} \right) fireman.

I \left( ^{\text{’ve got to}}_{\text{gotta}} \right) go.

They offer the best \left( ^{\text{cattle}}_{\text{beef}} \right) in town.

My daddy \left( ^{\text{taught}}_{\text{teached}} \right) me all I know.

Wir gehen \left( ^{\text{zu dem}}_{\text{zum}} \right) Strand.
Selection & Evolutionary Drift

Selection:

\[
\text{innovation } x \quad \text{(speaker a)} \quad \rightarrow \quad \text{propagation of } x \quad \text{(speaker b, speaker c, speaker d, etc.)}
\]

*Figure 3a.* Innovation – selection according to Croft (2000)

Evolutionary Drift:

\[
\begin{align*}
\text{innovation } x \quad \text{(speaker a)} & \quad \rightarrow \\
\text{innovation } x \quad \text{(speaker b)} & \quad \rightarrow \\
\text{innovation } x \quad \text{(speaker c)} & \quad \rightarrow \\
\text{innovation } x \quad \text{(speaker d)} & \quad \rightarrow \\
\text{etc.} & \\
\end{align*}
\]

*Figure 3b.* Spread of a change due to cumulative innovations (‘evolutionary drift’, after Croft 2000: 60)
The Problem of Linkage

Selection operates on *language use*, so how does it make its way into *grammar*?

Note: this problem is related to the question of (the locus of) replication: types or tokens?
Linguistic Replication

1. What are linguistic replicators in the first place?
2. What are the units of linguistic replication?
3. What is the material basis of linguistic replicators?
4. What is the replication mechanism?
Thus, the paradigm replicator in language is the lingueme, parallel to the gene as the basic replicator in biology; an utterance is made up of linguemes and linguemes possess structure.

William Croft (2000): Explaining Language Change
Dawkin’s Thought Experiment

Richard Dawkins is convinced that cultural replicators are cognitive units rather than their material effects and products! (Dawkins 1999)

Dawkin’s Thought Experiment:
Suppose a line of children that

- reproduce a drawing of the predecessor in line
- teach the successor how to produce a origami model
Exercise I

What is a 'type' and what is a 'token' in linguistic replication?

- token: the physical utterance / the product
- type: the mental representation / the instruction
Types and Tokens

Do linguistic tokens (physical utterances) or types (mental representations) replicate?

- The puzzle with ‘only tokens’-replication: “How can syntactic structure or even meaning successfully replicate?”

- The puzzle with ‘only types’-replication: “How can one copy what one cannot see?” (Ritt 2004)
Exercise II

How does the ’exemplar-model’ work?

» Experienced tokens are categorized by the number of features that coincide with a predefined type → prototype model

» Experienced tokens are input for a neural network, which connections weights represent the characteristics of the type → artificial neural network model

» Experienced tokens are registered, and the ’cloud’ they form together defines the type. → exemplar model
Types and Tokens

- **exemplar model**: tokens (exemplars) are mentally registered, and together (as a cloud) define the type (category) at hand.

- from an evolutionary point of view, language transmission may be both, horizontal (among speakers) and vertical (among generations)
Units of Replication

What units do linguemes/memes take?

Building blocks of linguistic structure:
- phonemes
- morphemes
- phrases
- constructions
- corresponding meaning
Material Basis of Replicators

What is the material basis of memes/linguemes?

- the *utterance* is the DNA of linguistic evolution (Croft 2000)
- *brain states* are a possible physical substrate of linguistic memes (Ritt 2004)

A ‘meme’ represents an assembly of nodes in a network of neurally implemented constituents, which has (a) a definite internal structure, (b) a definable position within a larger network configuration, (c) qualifies as a replicator in Dawkins’ sense.

*Nikolaus Ritt (2004): Selfish Sounds and Linguistic Evolution*

Note: Ritt’s sketch still lacks empirical and theoretical underpinning from the realm of neurolinguistics.
What kind of replication mechanisms are discussed in Section 4.3?

- social learning → crucial mechanism in cultural evolution (Pagel 2011)
- accommodation → important mechanism in the selection process of language change (Croft 2000)
- conformity to/violation of convention √ (Croft 2000)
  → normal/altered replication
- cultural replicators copy via *imitation* √ (Ritt 2004)
Priming is a well-known psycholinguistic mechanism that refers to the (usually) increased likelihood of linguistic elements to be repeated in the sense that either speakers are more likely to repeat what they’ve previously said (...) or that hearers may better parse what they’ve previously heard (...).

Annette Rosenbach (2008): Language Change as Cultural Evolution
Exercise IV

What is 'primeability'?  
- the degree of facilitation of effort for processing a linguistic element (through pre-activation)  
- the probability of repetition of the same linguistic element  
- the similarity of linguistic elements in terms of priming effects √
Priming...

- has been shown to operate on all linguistic levels:
  - evidence for the priming of form, on the phonological, lexical, and syntactic level
  - evidence for priming of meaning on the semantic level
- provides a plausible cognitive mechanism for both
  - faithful replication in terms of identity priming
  - non-faithful (i.e. altered) replication in terms of similarity priming
- might be related to unidirectional diachronic change
Priming Example

- **identity priming**
  a. At what time do you close? *at six*
  b. What time do you close? *six o’clock*

- **similarity priming**
  a. The 747 was alerted by the airport’s control tower. } *passive*
  b. The 747 was landing by the airport’s control tower.

- **unidirectional priming**
  a.i The dark widget is on front of the light widget.
  a.ii Next Wednesday’s meeting has been moved forward two days.
      When did the meeting take place? *Monday vs Friday*
  b.i Thursday comes before Saturday.
  b.ii Which of the two widgets is ahead? *dark vs light*

- **cross-linguistic priming (language contact)**
  a.i *il grappolo d’uva* (bunch of grapes)
  a.ii *Bündel von Trauben* vs *Traubenbündel*
Priming And Linguistic Replication

Questions:

1. What are the units of linguistic replication?
2. What are possible minimal steps in the process of altered replication (in terms of possible analogical extension)?

Answer(s): Whatever can be primed.
“...priming does not only offer a possible cognitive explanation for the observed change phenomena (...), but at the same time also turns the issue of unidirectionality and contact-induced change into an empirical question, as it allows for testing present-day speakers for past changes, under the uniformitarian assumption that the brains of today’s speakers do not differ from past speakers’ brains.”
Conclusion

An evolutionary approach in terms of priming may help

1. to ground evolutionary language change models more closely within cognition.
2. to make their assumptions more closely subject to empirical testing by psycholinguistic studies.
Homeworks

- Read the article ‘Using Social Impact Theory to simulate language change’ (Nettle, 1999)
- solve the appropriate exercises given on ILIAS